7. Solar Ready

§110.10

This chapter of the compliance manual addresses residential solar ready buildings requirements. These requirements are new for the 2013 Standards (§110.10). The intent of the solar ready requirements is to provide a penetration free and shade free portion of the roof, called the solar zone. This helps ensure future installation of a solar energy system is not precluded by the original design and layout of the building and its associated equipment. There are no infrastructure related requirements, such as installation of conduit or piping, inclusion of collateral structural loads, or pre-installed mounting hardware.

The requirements for solar ready buildings are mandatory measures for newly constructed low-rise residential buildings, and do not apply to either additions or alterations to low-rise residential buildings.

7.1 ~~Introduction and Scope~~Overview

The requirements for solar ready buildings are all mandatory, so there are no prescriptive and performance compliance paths. Since the provision are mandatory, there are also no tradeoffs allowed, and applicants must demonstrate compliance with each measure. There are, however, exceptions. Exceptions to mandatory requirements described in their corresponding sections.

The chapter is organized as follows:

~~7.1~~7.2 Covered Occupancies

§110.10(a)

The residential solar ready requirements apply to single family residences and low-rise multifamily buildings.

Single Family Residences

The solar ready requirements are applicable to newly constructed single family residences located in subdivisions with 10 or more residences and where the application for a tentative subdivision map for the residences has been deemed complete, by the enforcement agency, on or after January 1, 2014. This allowance is for situations where subdivisions may be partially built or where the layout of streets and residences has previously been approved by the enforcement agency. The allowance applies only to the solar ready requirements. The low-rise residential building shall comply with all other provisions of Title 24, Part 6, that are in effect on the date that the building permit application is submitted.

Low-rise Multifamily Buildings

The solar ready requirements are applicable to newly constructed low-rise multifamily buildings. By the Standards' definition, low-rise multifamily buildings have three stories or fewer.

~~7.2~~7.3 Solar Zone

§110.10(b)

The solar zone is an allocated space that is unshaded, unpenetrated, and free of obstructions. It serves as a suitable place that solar panels can be installed at a future date.

The solar zone can be located at any of the following locations:

- Roof of building
- Overhang of the building
- Roof and overhang of another structure located within 250 feet (75 meters) of the primary building
- Covered parking installed with the building project
- Other structures include, but are not limited to, trellises, arbors, patio covers, carports, gazebos, and similar accessory structures.

The solar zone design must comply with the access, pathway, smoke ventilation, and spacing requirements as specified in Title 24, Part 9 or in any requirements adopted by a local jurisdiction. These additional requirements are located in other Parts of Title 24 including Parts 2, 2.5, and 9 that are adopted by the California Building Standards Commission as part of the California Building Standards Code.

~~The solar zone is the portion of the roof that is reserved for the future installation of a solar energy system.~~

Minimum Area

§110.10(b)1

The total area of the solar zone may be comprised of multiple areas, if each area has no dimension which is less than five feet and each area is a minimum of 80 square feet (for buildings with roof areas that are equal to 10,000 square feet (1,000 square meters) or less). If the building has a roof area greater than 10,000 square feet, each area shall be a minimum of 160 square feet (16 square meters).

~~The solar zone shall comply with the access, pathway, smoke ventilation, and spacing requirements as specified in Title 24, Part 9 or in any requirements adopted by a local jurisdiction. [These requirements are located in other Parts of Title 24 that are not yet adopted. Additional detail may be added after Title 24, Parts 2, 2.5, and 9 are adopted by the California Building Standards Commission.]~~

A. Single Family Residences

The solar zone shall be located on the roof or overhang of the building. The solar zone shall have a total area that is no less than ~~150~~ 250 square feet (75 square meters). There are multiple exceptions, as described below, to the required total area.

Exceptions

1. No solar zone is required if a solar electric system with a nameplate DC power rating, measured under Standard Test Conditions, of no less than 1000 watts is permanently installed at the time of construction. The permanently installed solar electric system is not required to be located on the roof of the building.

2. No solar zone is required if a domestic solar water-heating system complying with the installation criteria in the Reference Residential Appendix RA4.4.21 and having a minimum solar savings fraction of 0.50 is permanently installed at the time of construction. This is the equivalent of the prescriptive solar water-heating system requirements when installing an electric-resistance storage or instantaneous water heater serving an individual dwelling unit. The permanently installed domestic solar water-heating collectors are not required to be located on the roof of the building.

3. The solar zone may be reduced to no less than 150 square feet (15 square meters) for single family residences with three stories or more and with a total floor area equal to 2,000 square feet (200 square meters) or less.

~~4.~~ The solar zone may be reduced to no less than 150 square feet (15 square meters) for single family residences with a whole house fan and where the residence is located in climate zones 8 through 14 and where the residence is located in the Wildland-Urban Interface Fire Area (as defined in Title 24, Part 2). This exception is to accommodate attic and roof venting requirements in these fire areas.

4. The solar zone may be reduced to 50 percent of the potential solar zone area. The potential solar zone area is the total area of the roof where annual solar access is 70 percent or greater. This exception

reduces the required solar zone area when the roof is shaded by objects which are not located on the roof or any other part of the building. If the roof is shaded such that there is no potential solar zone area, then no solar zone is required.

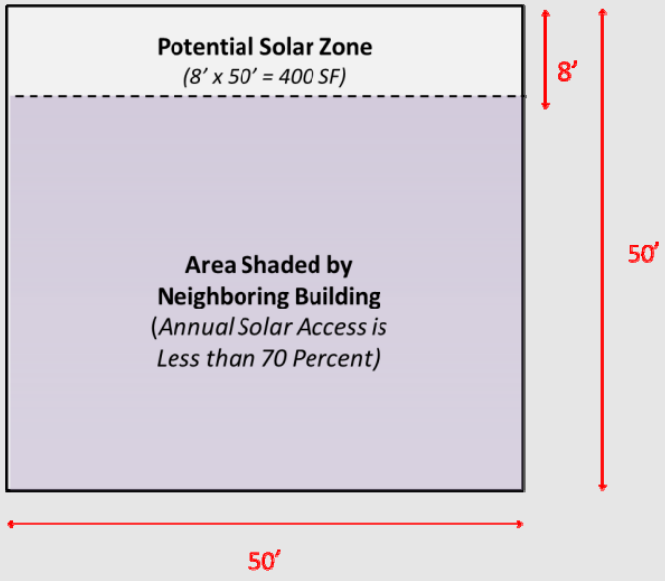
For purposes of the solar ready requirements, solar access is the ratio of solar insolation including shade to the solar insolation without shade.

Annual solar access is most easily determined by capturing digital photographs at the corners of the solar zone with an instrument that is equipped with a fisheye lens and specialized imagery processing software. However, this is not possible during the design phase for newly constructed buildings. During the design phase for newly constructed buildings, annual solar access can be quantitatively determined using several computer-aided design (CAD) software packages which can import a CAD file of the building and perform a shading analysis or several online solar quoting tools which make use of both overhead and orthogonal aerial imagery. Annual solar access can be qualitatively determined using several three-dimensional modeling programs.

Example 7-1

Question

The house has a total roof area of 2,500 SF. The neighbor's house and trees shade the roof, so 2,100 SF of the roof has less than 70 percent annual solar access. How big does the solar zone have to be?



Answer

If the entire roof were to have an annual solar access of 70 percent or greater, the minimum solar zone would have been 2,50 SF. However, the since the potential solar zone is only 2,500 – 2,100 = 400 SF, the minimum solar zone can be reduced to ~~half~~ 50 percent ~~the area~~ of the potential solar zone, or 200 SF.

~~For purposes of the solar ready requirements, solar access is the ratio of solar insolation including shade to the solar insolation without shade.~~

$$\text{Solar Access} = \frac{\text{Solar Insolation Including Shade}}{\text{Solar Insolation Without Shade}}$$

~~Annual solar access is most easily determined by capturing digital photographs at the corners of the solar zone with an instrument that is equipped with a fisheye lens and specialized imagery processing software. However, this is not possible during the design phase for newly constructed buildings. During the design phase for newly constructed buildings, annual solar access can be quantitatively determined using several computer-aided design (CAD) software packages which can import a CAD file of the building and perform a shading analysis or several online solar quoting tools which make use of both overhead and orthogonal aerial imagery. Annual solar access can be qualitatively determined using several three-dimensional modeling programs.~~

5. The solar zone may be reduced to no less than 150 square feet (15 square meters) if all thermostats in the residence are Occupant Controlled Smart Thermostats (OCST) with communications capabilities enabled to receive and respond to Demand Response signals. An OCST is a setback thermostat with communication capabilities that enable the occupant to receive Demand Response related messages and respond to those signals by automatic adjustment of the thermostat setpoint as described in Joint Appendix JA5 (subject to occupant participation). Enabling communications capabilities requires that the OCST has one of the following: onboard communications capabilities, an installed communications module for OCSTs with removable communications module(s), or an installed communications gateway for an OCST where an external gateway is required for communications. ~~OCST are thermostats which are capable of enabling both communications and demand response. (OCST shall comply with Reference Joint Appendix JA5.) These functions may onboard the OCST or provided on a removable module which can be installed in the OCST.~~

6. No solar zone is required if all of the following conditions are met:

   a All thermostats in the residence are OCST with communications capabilities enabled to receive and respond to Demand Response signals (subject to occupant participation). Enabling communications capabilities requires that the OCST has one of the following: onboard communications capabilities, an installed communications module for OCSTs with removable communications module(s), or an installed communications

gateway for an OCST where an external gateway is required for communications.~~and are capable of receiving and responding to demand response signals. This means that demand response has been enabled on OCST with onboard functions. For OCST which allow use of a removable module, it means the removable module has been installed and demand response has been enabled.~~

b All permanently installed indoor lighting is high efficacy and is installed in kitchens, bathrooms, utility rooms, and garages at a minimum. Permanently installed nightlights complying with Section 150.0(k)1E and lighting integral to exhaust fans complying with Section 150.0(k)1F are allowed.

c All permanently installed lighting in bathrooms is controlled by a vacancy sensor, except for one high efficacy luminaire with total lamp wattage no ~~less~~ greater than 26 watts.

d Every room which does not have permanently installed lighting has at least one switched receptacle installed.

e All permanently installed outdoor lighting is high efficacy and controlled by an on/off switch and either a photocontrol or astronomical time clock or energy management control system.

B. **Low-rise Multi-family Buildings**

The solar zone shall be located on the roof or overhang of the building or on the roof or overhang of another structure located within 250 feet (75 meters) of the building or on covered parking installed with the building project. Other structures include, but are not limited to, trellises, arbors, patio covers, carports, gazebos, and similar accessory structures. The solar zone shall have a total area that is no less than 15% of the total roof area of the building after subtracting any skylight area from the roof area. There are multiple exceptions, as described below, to the required total area.

Exceptions

1. No solar zone is required if a solar electric system with a nameplate DC power rating, measured under Standard Test Conditions, of no less than 1 watt per square foot of roof area is permanently installed at the time of construction. The permanently installed solar electric system is not required to be located on the roof or overhang of the building or on the roof or overhang of another structure.

2. No solar zone is required if a domestic solar water-heating system complying with Section 150.1(c)8Ciii is permanently installed at the time of construction. This is the equivalent of the prescriptive solar water-heating system requirements when installing a water-heating system serving multiple dwelling units. The permanently installed domestic solar water-heating collectors are not required to be located on the roof or overhang of the building or on the roof or overhang of another structure.

3. The solar zone may be reduced to 50 percent of the potential solar

zone area. The potential solar zone area is the total area of the roof where annual solar access is 70 percent or greater. This exception reduces the required solar zone area when the roof is shaded by objects which are not located on the roof or any other part of the building. If the roof is shaded such that there is no potential solar zone area, then no solar zone is required. For a discussion of annual solar access, see Exception 5 under Single Family Residences.

4. No solar zone is required if all of the following conditions are met:

   ~~1.~~a All thermostats in each dwelling unit are Occupant Controlled Smart Thermostats (OCST) with communications capabilities enabled to receive and respond to Demand Response signals. An OCST is a setback thermostat with communication capabilities that enable the occupant to receive Demand Response related messages and respond to those signals by automatic adjustment of the thermostat setpoint as described in Joint Appendix JA5 (subject to occupant participation). Enabling communications capabilities requires that the OCST has one of the following: onboard communications capabilities, an installed communications module for OCSTs with removable communications module(s), or an installed communications gateway for an OCST where an external gateway is required for communications.~~and are capable of receiving and responding to demand response signals. (OCST shall comply with Reference Joint Appendix JA5.) This means that demand response has been enabled on OCST with onboard functions. For OCST which allow use of a removable module, it means the removable module has been installed and demand response has been enabled.~~

   ~~f~~b All permanently installed indoor lighting in each dwelling unit is high efficacy and is installed in kitchens, bathrooms, utility rooms, and private garages at a minimum. Permanently installed nightlights complying with Section 150.0(k)1E and lighting integral to exhaust fans complying with Section 150.0(k)1F are allowed.

   ~~g~~c All permanently installed lighting in bathrooms is controlled by a vacancy sensor, except for one high efficacy luminaire with total lamp wattage no less than 26 watts.

   ~~h~~d Every room which does not have permanently installed lighting has at least one switched receptacle installed.

   ~~i~~e All permanently installed outdoor lighting for private patios, entrances, balconies, and porches is high efficacy and controlled by an on/off switch and either a photocontrol or astronomical time clock or energy management control system.

Orientation

§110.10(b)2

For both single family residences and low-rise multi-family buildings, all sections of the solar zone on steep-sloped roofs (ratio of rise to run of greater than 2:12) shall be oriented between 110 degrees and 270 degrees of true

north. The orientation is important because it ensures a reasonable solar exposure if a solar energy system is installed in the future.

If a solar zone is located on a low-sloped roof (ratio of rise to run less than 2:12), the orientation requirement does not apply.

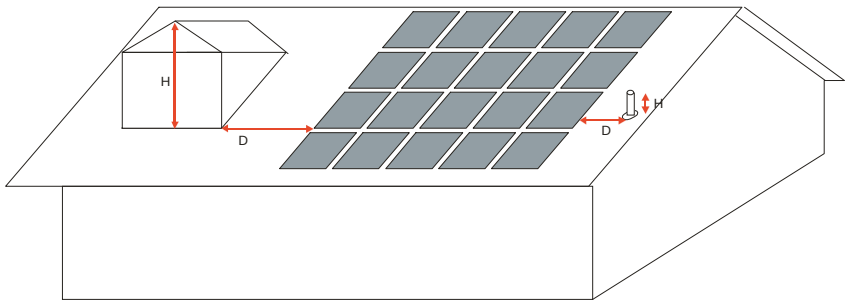
Shading

§110.10(b)3

For both single family residences and low-rise multi-family buildings , the solar zone shall be free from roof penetrations and shall not have any obstructions such as vents, chimneys, architectural features, or roof mounted equipment located in the solar zone. This requirement is so that the solar zone remains clear and open for the future installation of a solar energy system.

For both single family residences and low-rise multi-family buildings, any obstruction, located on the roof or any other part of the building, that projects above the solar zone shall be located at a sufficient horizontal distance away from the solar zone, in order to reduce the resulting shading of the solar zone. For each obstruction, the horizontal distance ("D") from the obstruction to the solar zone shall be at least two times the height difference("H") between the highest point of the obstruction and the horizontal projection of the nearest point of the solar zone.

$$D \geq 2 \times H$$



Source: California Energy Commission

Figure 7.1 Artistic Depiction of "H" and "D"

Any obstruction oriented north of all points of the solar zone is not subject to these requirements. Any obstruction which is not located on the roof or another part of the building, such as landscaping or a neighboring building, is not subject to these requirements.

~~7.3~~7.4 Construction Documents

These requirements apply to both single family residences and low-rise multi-family buildings.

Structural Design Loads

§110.10(b)4

For the areas of the roof designated as the solar zone, the structural design loads for roof dead load and roof live load shall be clearly indicated on the construction documents. This is required so that the structural loads are known if a solar energy system is installed in the future. There are no requirements for the inclusion of any collateral loads for future solar energy systems.

Interconnection Pathways

§110.10(c)

The construction documents shall indicate:

1. A location for inverters and metering equipment for future solar electric systems.
2. A pathway for routing conduit from the solar zone to the point of interconnection with the electrical service. There is no requirement to install any conduit.
3. A pathway for routing of plumbing from the solar zone to the water-heating system. There is no requirement to install any piping.

Documentation

§110.10(d)

A copy of the construction documents or a document containing the required solar ready information shall be provided to the occupant. This is required so that the solar ready information is available if a solar energy system is installed in the future.

~~7.4~~7.5 Main Electrical Service Panel

§110.10(e)

This requirement applies only to single family residences. The main electrical service panel shall have a minimum busbar rating of 200 amps and shall have a reserved space to allow for the installation of a double pole circuit breaker. The reserved circuit breaker space shall be on the opposite (load) end from the input feeder or main circuit location. The reserved circuit breaker space shall be permanently marked as “For Future Solar Electric”. These items are required to facilitate the possible future installation of a solar electric system.

7.6 Fire Marshall’s Solar Access Requirements

The California Department of Forestry and Fire Protection - Office of the State Fire Marshal (CAL FIRE-OSFM), local Fire Departments (FD), and the solar photovoltaic industry have developed this guideline for installations to increase

public safety for all structures equipped with solar photovoltaic systems. The intent of this guideline is to provide the solar photovoltaic industry with information that will aid in the designing, building, and installation of solar photovoltaic systems in a manner that should meet the objectives of both the solar photovoltaic industry and the Fire Service.

The provisions of this guideline, if adopted by the local enforcing agency by local ordinance, is meant to apply to the design, construction and installation of solar photovoltaic systems on buildings regulated by Title 24 of the California Building Standards Codes.

Provisions contained in this guideline do not apply unless specifically adopted by local ordinance by a local enforcing agency in compliance with Health and Safety Code Section 18938(b) for Building Standards Law, Health and Safety Code Section 17950 for State Housing Law and Health and Safety Code Section 13869.7 for Fire Protection Districts.

The entire SOLAR PHOTOVOLTAIC INSTALLATION GUIDELINE can be accessed at:

http://osfm.fire.ca.gov/pdf/reports/solarphotovoltaicguideline.pdf

The following excerpts from this Guideline illustrate some acceptable solar access techniques. For complete requirements and compliance with the code, refer to the Guideline.

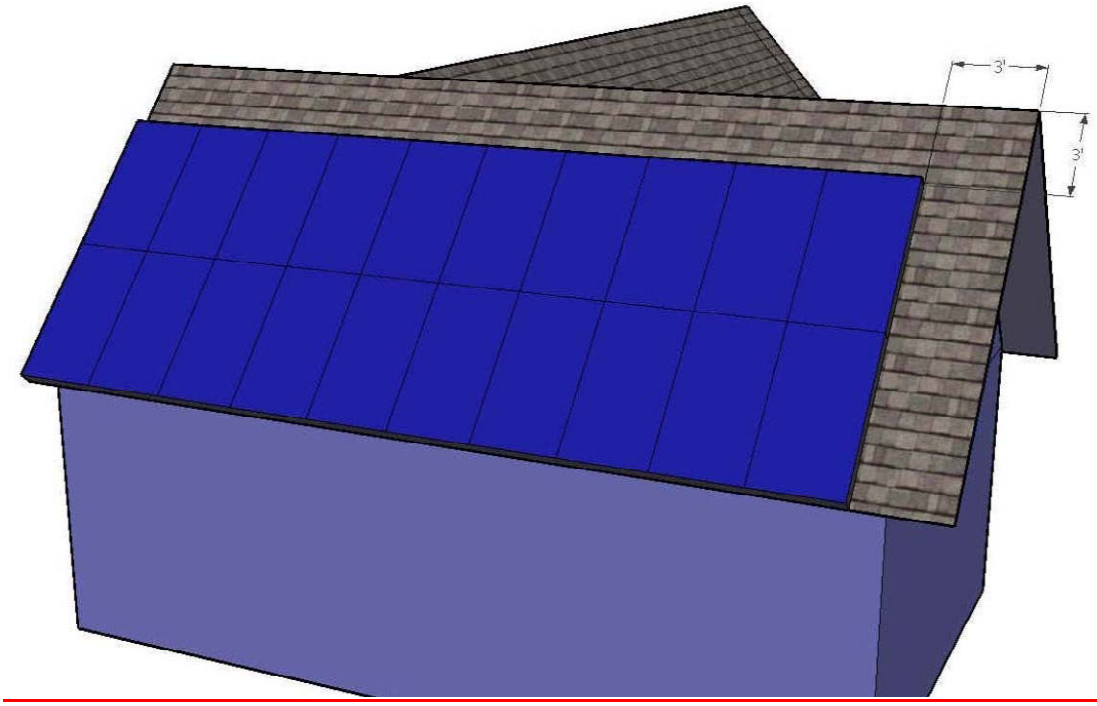


Figure 7-2 Cross Gable Roof

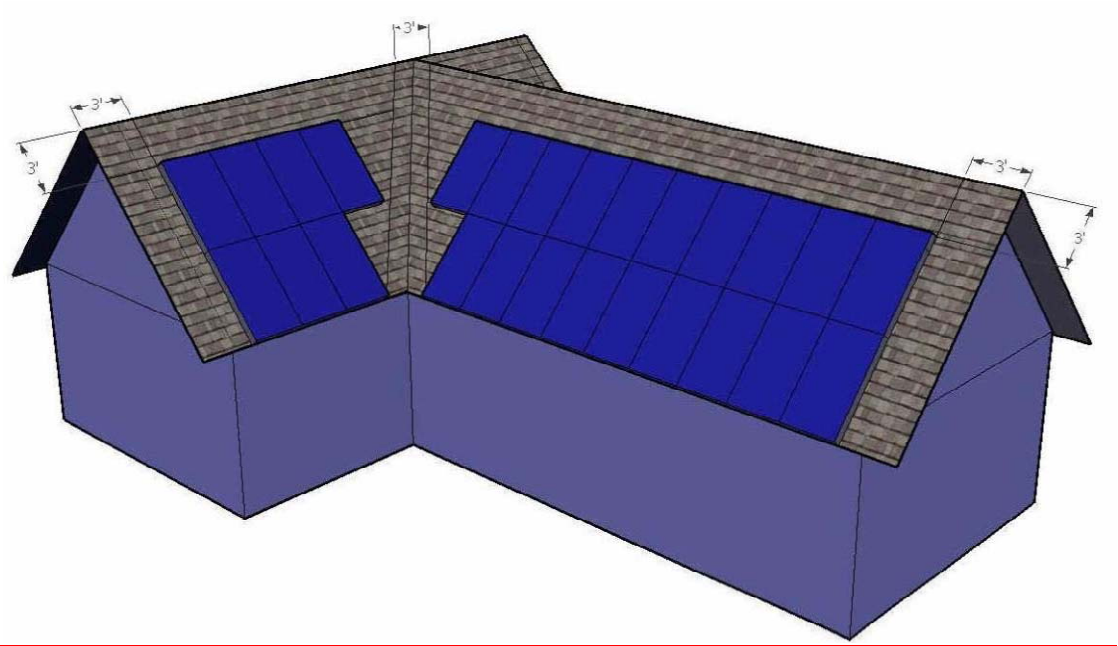


Figure 7-3 Cross Gable with Valley

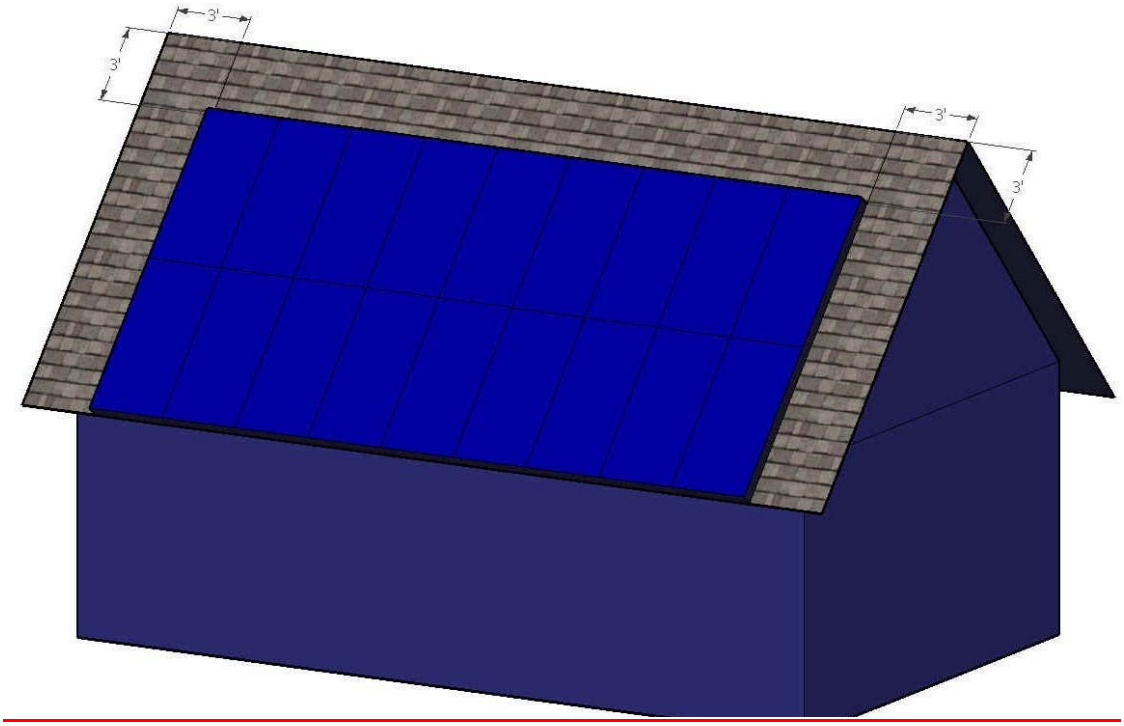


Figure 7-4 Full Gable

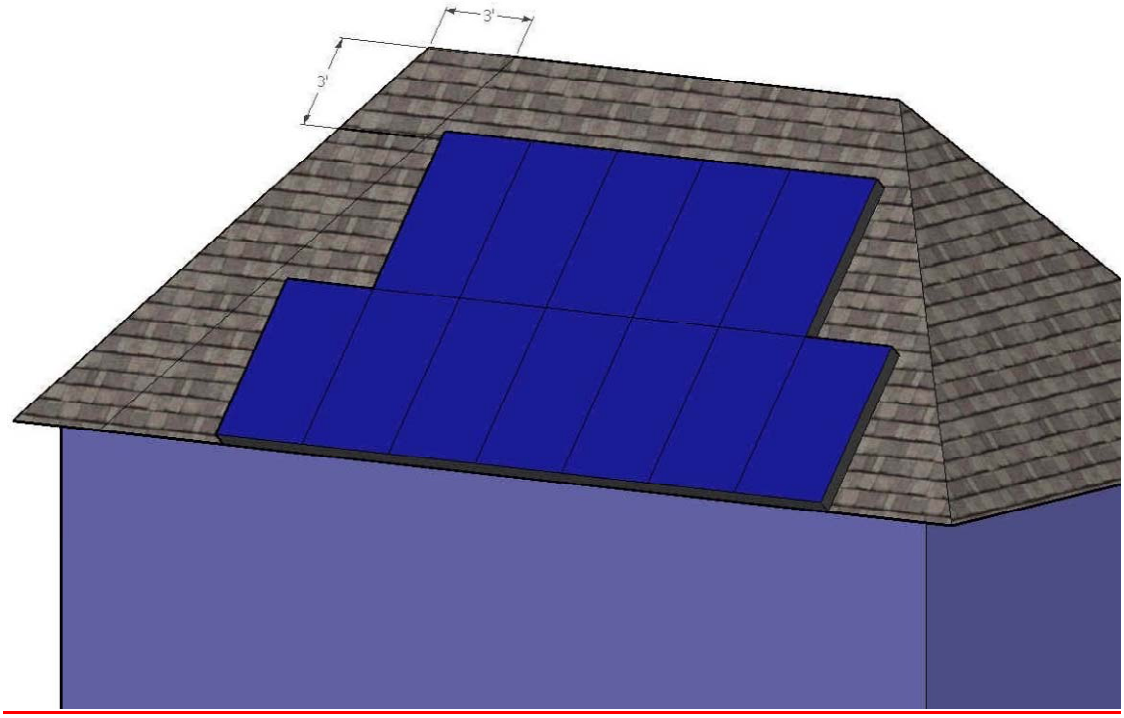


Figure 7-5 Full Hip Roof